SPECIFICATION AMENDMENTS

Please amend the paragraph beginning at page 1, line 1 as follows:

"The present invention relates to a positioning apparatus for a position-controlled device comprising a gravity compensation [[means]] device compensating gravitational forces acting on said position-controlled device. Further, the present invention relates to [[a gravity compensation device and]] a method for compensating gravitational forces."

Please amend the paragraph beginning at page 1, line 27 as follows:

"The present invention provides a positioning apparatus, especially for measuring machines, manufacturing machines or the like, comprising at least one position sensor, at least one position controller and at least one position actuator, wherein the or each position sensor measures the position of a position controlled device, wherein the or each position controller uses measurement signals provided by the or each position sensor as input signals, and wherein output signals generated by the or each position controller are used by the or each position actuator to control the position of said position-controlled device, the positioning apparatus further comprising a gravity compensation [[means]] device compensating gravitational forces acting on said position-controlled device, wherein the gravity compensation [[means comprise]] device includes at least one gravity compensation controller and at least one gravity compensation actuator, wherein the or each gravity compensation controller uses the output signals generated by the or each position controller as input signals, thereby generating output signals used by the or each gravity compensation actuator to compensate gravitational forces acting on said position-controlled device. The present invention has several advantages compared with the prior art. Unlike air cylinders, the present invention does not require any air supply. The present invention provides a cheaper and more compact solution. Compared to the prior art using mechanical springs, the present invention is less sensitive to load variations and introduces less disturbance force in case of relative motion between the position-controlled device and its environment. Compared to the prior art using permanent magnets, the present

invention is lighter and less expensive, and less sensitive to load variations. The solution of the present invention is suited to long strokes and variable load situations."

Please amend the paragraph beginning at page 2, line 20 as follows:

"In accordance with a preferred embodiment of the invention the gravity compensation actuator comprises <u>a</u> spring [[means]], <u>a</u> string [[means]], <u>a</u> pulley [[means]] and <u>a</u> motor [[means]]. The spring [[means]] is attached with a first end to the position-controlled device and with a second end to the string [[means]]. The string [[means]] is wound around the pulley [[means]], whereby the pulley [[means]] is driven by the motor [[means]], and whereby the motor [[means]] is controlled by the output signals generated by the gravity compensation controller. The pulley [[means]] is driven by the motor [[means]] in a way that the tension in the spring [[means]] is kept constant and equal to the gravitational forces acting on said position-controlled device."

Please amend the paragraph beginning at page 2, line 28 as follows:

"In accordance with a further improved, preferred embodiment of the invention the gravity compensation [[means comprise]] <u>device includes</u> two gravity compensation controllers, wherein a first gravity compensation controller uses the output signals generated by the position controller as input signals, wherein a second gravity compensation controller uses the output signals generated by the first gravity compensation controller as input signals, and wherein output signals of said second gravity compensation controller are used to control the gravity compensation actuator. The output signals generated by the first gravity compensation controller are summed with a position setpoint signal of said position controller, whereby the resulting signal is used as setpoint for said second compensation gravity controller. The second gravity compensation controller uses the measurement signal of a motor position sensor as input signal, whereby said motor position sensor measures the position of the motor [[means]] of said gravity compensation actuator."

Please amend the paragraph beginning at page 4, line 10 as follows:

"The positioning apparatus 10 further comprises [[gravity compensation means or]] a gravity compensation device 15 for compensating gravitational forces acting on the position-controlled device 11. According to the present invention, the gravity compensation device 15 of the position apparatus 10 shown in Fig. 1 comprises a gravity compensation controller 16 and a gravity compensation actuator 17. The gravity compensation controller 16 uses the output signals generated by the position controller 13 as input signal or so-called controlled variable. The gravity compensation controller 16 generates an output signal as a function of the output signal of the position controller 13. The output signal of the gravity compensation controller 16 is used by the gravity compensation actuator 17 to compensate gravitational forces acting on the position-controlled device 11."

Please amend the paragraph beginning at page 4, line 20 as follows:

"The gravity compensation actuator 17 comprises a spring [[means]] 18, a string [[means]] 19, a pulley [[means]] 20 and a motor [[means]] 21. The spring [[means]] 18 is with a first end attached to the position-controlled device 11 and with a second, opposite end attached to the string [[means]] 19. The string [[means]] 19 is wound around the pulley [[means]] 20. The pulley [[means]] 20 is driven by the motor [[means]] 21, whereby a gearhead 22 is located between the pulley [[means]] 20 and motor [[means]] 21. In the embodiment shown in Fig. 1 the output signal generated by the gravity compensation controller 16 is directly used as input signal for the motor [[means]] 21 which is designed as a voltage-driven direct current motor. Said voltage-driven direct current motor is controlled on the basis of the output signal of the position controller 13 only. The embodiment shown in Fig. 1 has a very simple design which can even be realized using analogue electronics."

Please amend the paragraph beginning at page 5, line 3 as follows:

"In comparison with the embodiment of Fig. 1 the positioning apparatus 23 of Fig. 2 comprises a gravity compensation device 24 including two gravity compensation controllers. A

first gravity compensation controller 25 uses the output signal from the position controller 13 as input signal or so-called controlled variable. The output signal from said first gravity compensation controller 25 is transmitted to a summing device 26. In the summing device 26, the output signal from the first gravity compensation controller 25 is summed with the set point signal of the position controller 13, whereby the set point signal of the position controller 13 is multiplied by a transmission factor as indicated by box 27 in Fig. 2. The signal resulting from the summation of the output signal from the first gravity compensation controller 25 and the set point signal of the position controller 13 multiplied by the transmission factor is transmitted to a second gravity compensation controller 28 and used as set point for the second gravity compensation controller 28. The output signal generated by the second gravity compensation controller 28 is used to control the gravity compensation actuator 17. The gravity compensation actuator 17 of the embodiment shown in Fig. 2 comprises like the gravity compensation actuator of the embodiment in Fig. 1 spring [[means]] 18, string [[means]] 19, pulley [[means]] 20, motor [[means]] 21 and a gearhead 22. In order to avoid duplications, the same reference signs are used for similar components."

Please amend the paragraph beginning at page 5, line 20 as follows:

"The second gravity compensation controller 28 of the embodiment according to Fig. 2 uses a measurement signal of a motor position sensor 29 as input signal or so-called controlled variable. As a function of the measurement signal provided by the motor position sensor 29 and as a function of the set point signal the second gravity compensation controller 28 generates an output signal used to control the motor [[means]] 21 of the gravity compensation actuator 17. In the embodiment according to Fig. 2, the knowledge on the motion of the position-controlled device 11 is used in the controls of the motor [[means]] 21. This is realized by using the motor position sensor 29 and a separate control loop provided by the second gravity compensation controller 28. The set point for said second gravity compensation controller 28 is directly related to the set point of the position controller 13. The gravity compensation device 24 of Fig. 2 stills tries to control the output of the position control loop provided by the position controller 13 to

zero, however, it now acts on the set point of the control loop for the motor [[means]] 21 provided by the second gravity compensation controller 28."

Please amend the paragraph beginning at page 6, line 21 as follows:

"Figs. 4 and 5 show a first use of a gravity compensation device in the particular application of a positioning stage 30. Figs. 4 and 5 show the gravity compensation actuator 17 of the gravity compensation device including the spring [[means]] 18, the string [[means]] 19 wound around the pulley [[means]] 20, whereby the pulley [[means]] 20 is driven by the motor [[means]] 21 and gearhead 22. In the use shown in Figs. 4 and 5 the motor [[means]] 21, the gearhead 22, the pulley 20 and the spring 18 are attached to the first slide 31. Guide rollers 36 are attached to the second slide 32 to guide the string 19 from the spring 18 to the pulley 20. In the particular application shown in Figs. 3 to 5 the entire gravity compensation device is applied horizontally and integrated into the positioning stage 30."

Please amend the paragraph beginning at page 7, line 1 as follows:

"According to Figs. 6 and 7, the pulley 20, motor 21 and gearhead 22 are mounted on a first wall and the spring 18 is mounted on an adjacent, second wall of the surroundings of the positioning stage 30. On the first slide 31 and the second slide 32 there are attached guide rollers 37. A first guide roller 37 is attached to the first slide 31 and a second guide roller 37 is attached to the second slide 32. The guide rollers 37 are used to guide the string 19 from the pulley 20 to the spring 18 while bringing the string 19 into engagement with the slides 31 and 32. In the use shown in Figs. 6 and 7, disturbance forces generated by the motor [[means]] 21 of the gravity actuator will not directly act on the slides 31, 32, 33, and 34, which is of advantage in high-precision motion systems."

Please amend the abstract as follows:

"The present invention relates to a positioning apparatus. The positioning apparatus comprises at least one position sensor, at least one position controller and at least one position actuator, wherein the or each position sensor measures the position of a position-controlled

device, wherein the or each position controller uses measurement signals provided by the or each position sensor as input signals, and wherein output signals generated by the or each position controller are used by the or each position actuator to control the position of said position-controlled device. The positioning apparatus further comprising a gravity compensation [[means]] device compensating gravitational forces acting on said position-controlled device, wherein the gravity compensation [[means comprises]] device includes at least one gravity compensation controller and at least one gravity compensation actuator, wherein the or each gravity compensation controller uses the output signals generated by the or each position controller as input signals, thereby generating output signals used by the or each gravity compensation actuator to compensate gravitational forces acting on said position-controlled device."